position shifts 1.5 cm the CTV coverage drops rapidly for RA isotropic (V95(CTV) from 100% to 83%) whereas the RA anisotropic were more robust (V95(CTV) from 100% to 98%). The over dosage of ORs, e.g. the spinal cord, were in general of no clinical importance. In general, the most preferable method to increase the robustness was to use arcs with avoiding sectors in combination with arcs without avoiding sectors. If all arcs had avoiding sectors this limited the beam angles geometry at the expense of coverage of targets in the upper parts of the head and neck.

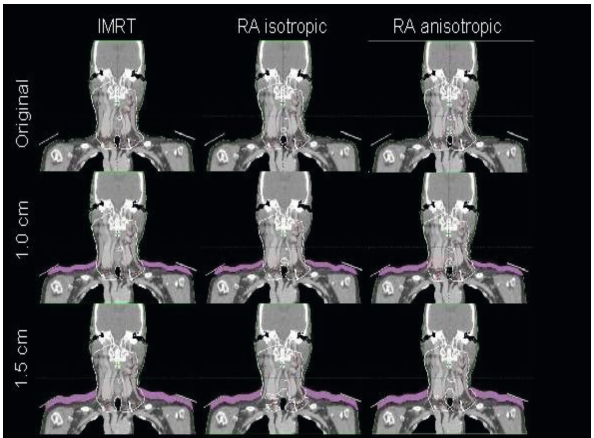

Figure: *Illustration how the CTV (grey) is covered by the 95% isodose (white) on the original CT and when simulating that shoulders moves up 1.0 and 1.5 cm.*

Conclusions: RA is less robust to changes in patient shoulders position than IMRT. It is possible to increase the robustness of the RA TPs by taking the shoulders into account in the optimisation. The most preferable method found is the use of avoiding sectors in combination with arcs without avoiding sectors.

PD-0272

Can CBCT image quality be improved to reduce inter observer error in patients receiving radiotherapy to the prostate?

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Purpose/Objective: Cone beam CT provides 3D volumetric imaging and enables registration between planning CT and treatment image on soft tissue. Inter observer error in defining the prostate on CT is understood and also occurs when registering CBCT. To enable clinical implementation of CBCT soft tissue imaging the uncertainty in the registration would have to be less than the difference between using bony anatomy and soft tissue (measured using gold markers) for registration. This study investigates if improvements in image quality by reducing scan length or increasing the dose can reduce the inter observer errors.
Materials and Methods: CBCT images were acquired using a standard 10 cm length image, a novel 7cm length image with standard dose (1644mAs) and a high dose 7cm length image (2632mAs) on patients receiving radiotherapy for prostate cancer. Eight observers (2 clinicians and 6 radiographers) registered the images (Elekta Synergy XVIv4.5). Guidelines and training were provided. The SD of the inter observer error would have to be less than 50% of the SD of the difference between bony anatomy and soft tissue. i.e. <1.2mm (SI and RL) and <1.7mm(AP) in more than 70% of patients. If the true percentage is 90%, then a total of 28 patients will provide 80% power using a one-sided alpha of 0.05. The SD of the observers displacements were calculated using ANCOVA and the percentage of patients with standard deviations < 1.2 (RL and SI) and 1.7mm (AP) was calculated.
Results: Images were acquired on 31 patients. The RL direction was consistent and successful in all images. In the SI direction the SD was the least in the 7cm length standard dose image and in the AP direction, the least in the 10cm length image and 7cm length.

	7 (standard dose)			10 (standard dose)			7 (high dose)		
	RL (mm)	SI (mm)	AP (mm)	RL (mm)	SI (mm)	AP (mm)	RL (mm)	SI (mm)	AP (mm)
SD	3.0	2.6	3.9	2.4	2.8	3.6	2.9	2.9	4.1
% of images <1.2mm (RL and SI direction) and <1.7mm (AP direction).	96%	67%	58%	100%	51%	58%	97%	51%	45%

Other factors which may have affected the SD need to be investigated.
Conclusions: Reducing margins when using CBCT images without markers should be done with caution. The use of the 7cm aperture using standard dose and improved methods to reduce inter observer error in the SI and AP will be investigated further.

PD-0273

Cardiac volume reduction during chemo-radiotherapy of oesophageal cancer patients

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Purpose/Objective: Anatomical changes which occur over the course of radiotherapy treatment establish the rationale of modern adaptive radiotherapy. In irradiated oesophageal cancer patients, we discovered a volumetric change of the heart; a phenomenon that has not been previously described. The aim of this study was to quantify this change in heart volume during the chemoradiation period.
Materials and Methods: Twenty-four consecutive patients were included in this study, starting from March 2012. Patients were treated with 2 protocols. One group of patients was treated pre operatively with 41.4 Gy in fractions (#) of 1.8 Gy and the other treated for the inoperable disease with 50,4 Gy in fractions of 1.8 Gy, both combined with weekly carboplatin (AUC=2) and paclitaxel (50 gr/cm2).
Radiotherapy treatment was delivered using a 4-field conventional treatment technique. All patients were incorporated in an *extended No Action Level* offlineposition correction protocol with weekly follow-up using Conebeam-CT (CBCT).
To evaluate the heart volume, the CBCT-scans of fraction 2 and 19 were exported to the treatment planning system (Oncentra,Elekta, Sweden). Heart contours were delineated using RTOG-guidelines for lung cancer treatment and the resulting heart volumes were recorded for every CBCT-scan.
Fo rthe statistical evaluation, mean and standard deviation (SD) of the heart volume on the evaluated days were calculated. Furthermore, the mean and standard deviation of the reduction in change in the heart volume were calculated. To determine statistical significance, paired *t*-tests were performed between the two assessed treatment days. These parameters were calculated for the 2 different treatment protocols separately, as well as for the total patient group.
Results: Eighteen patients were treated according to the neo-adjuvant protocol and six within the inoperable protocol. The differences in heart volume between fraction 2 and 19 were statistically significant (table 1). Three patients showed an increase in measured heart volume and 21 a decrease. Maximum measured relative reduction was 16% (128cc) and is illustrated by a transverse image of day 19 in figure 1.